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FILING DATE: *March 01, 2004*

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PROVISIONAL APPLICATION FOR PATENT COVER SHEET

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53(c).

Express Mail Label No.

INVENTOR (S)		
Given Name (first and middle (if any))	Family Name or Surname	Residence (City and either State or Foreign Country)
Chaim	**Ash**	**20, Zamenhof St., apt. 10, Netanya 42309, Israel**

☐ *Additional inventors are being named on the____ separately numbered sheets attached hereto*

TITLE OF THE INVENTION (500 characters max)

A System a Method and an Apparatus for Performing Wireless Measurements, for Automatically Generating Complete Set of As-Built Drawings, and for Positioning and Laying Out.

Direct all correspondence to: **CORRESPONDENCE ADDRESS**

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OR

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ENCLOSED APPLICATION PARTS *(check all that apply)*

☒	Specification	*Number of Pages*	6	☐ CD(S), Number	
☒	Drawing(s)	*Number of sheets*	2	☐ Other (specify)	
☐	Application Data Sheet. See 37 CFR 1.76				

METHOD OF PAYMENT OF FILING FEES FOR THIS PROVISIONAL APPLICATION FOR PATENT

☒	Applicant claims small entity status. See 37 CFR 1.27.		FILING FEE AMOUNT($)
☐	A check or money order is enclosed to cover the filing fees		
☐	The Commissioner is herby authorized to charge filing fees or credit any payment to Deposit Account Number:		$80
☒	Payment by credit card. Form PTO-2038 is attached.		

The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.

☐ No

☐ Yes, the name of the U.S. Government agency and the Government contract number are:_____

Respectfully submitted,

SIGNATURE Chaim Ash Date **February 25, 2004**

TYPED or PRINTED NAME **ASH CHAIM** REGISTRATION NO. *(if appropriate)*

TELEPHONE +972 3 516 3962 Docket Number: **A/0059/0000**

USE ONLY FOR FILING A PRVISIONAL APPLICATION FOR PATENT

This collection of information is required by 37 CFR 1.51. The information is used by the public to file (and by the PTO to process) a Provisional application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 8 hours to Complete, including gathering, preparing, and submitting the complete provisional application to the PTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark office, U.S. Department of Commerce, Washington, D.C. 20231. DO NOT SEND FEES OR COMPLETE FORMS TO THIS ADDRESS. SEND TO: Box Provisional Application, Assistant Commissioner for Patents, Washington, D.C. 20231.

A System a Method and an Apparatus for Performing Wireless Measurements, for Automatically Generating Complete Set of As-Built Drawings, and for Positioning and Laying Out.

Abstract

A wireless method and device for measuring and laying out is particularly intended for both measuring of existing buildings (constructions, archeological sites etc.) and immediate automatic creation of computer-made drawings. In addition it can be used for laying out of axes and columns at the beginning stage of construction with each mark watching on a layout of a drawing on computer screen, for quality and exactitude control of constructions or assembling etc. This method and device is based on an initial transmission of indirect signal from one point and transmission *in response* from another point. A multiplication of these signal exchanges considerably increases measurement precision. The method and device can be used by architects, builders, archeologists, geodesists and other experts connected to construction.

BACKGROUND

The present invention relates in general to performing measurements of distances in construction sites, and in particular to performing measurements of distances in construction sites by wireless means. It is also related to automatic generation of as-built drawings, to marking positions in relation to an existing computer drawing and to construction quality control.

Prior art for performing wireless measurements use laser based optical device. These devices perform vertical and horizontal scanning on a tight grid in order to determine the position of surfaces in their immediate surrounding. These methods have several drawbacks: in order to be effectively performed the measurements they need to relay on preliminary data such as drawings or sketches, they cannot create automatic drawing based on the measurements that they perform, and any interfering obstacle in the line of sight between the scanning device and the measured surfaces prevent them from achieving correct measurements.

It is therefore the purpose of the present invention to provide an efficient means for a cost effective easy to system for wirelessly and accurately performing measurements in diverse environments and automatically producing as-built three dimensional virtual models and drawings (plans, sections and elevations).

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is an illustration of the central collector in accordance with the present invention;

Figure 2 is an illustration of the central collector's method of marker positioning in accordance with the present invention;

Figure 3 is an illustration of the present invention method of operation in a construction site.

DESCRIPTION

The present invention is a new multifunctional low cost solution for performing measurements in construction sites and automatically extracting a three dimensional virtual model, plans, elevations and sections drawings based on these measurements. The preferred embodiment of the present invention consists of a set of transceiver beacons, spread around the measured construction, communicating in indirect signals from and to each other and from and to a central signal collector which is connected to a computer. The communication protocol

which prevents communication collisions and the computer software that performs the spatial calculations and the construction of the three dimensional virtual model and elevation and section drawings are integral parts of the present invention.

In general, the beacon consists of a signal processor, a transceiver and a micro-strip antenna. The central collector is illustrated in figure 1, it contains three beacons 101, 102, 103 which are positioned at set known distances apart from each other and are interconnected via communication lines A, B, C. The central collector 100 is in turn connected to a computer through a port.

In order to perform a measurement, an additional beacon is attached to the measured object and communicates with the central collector. As illustrated in figure 2 the beacon 200 establishes a bidirectional signal exchange session with the three beacons 101, 102, 103 of the central collector 100. The exact position of the beacon 200 is determined as a vertex of a triangle pyramid with the three beacons 101, 102, 103 of the central signal collector 100 as a pyramid base. Each beacon 200 placed on a target defines a measured point. The beacons can also be grouped by hardware or by software so that the group of beacons defines a measured surface (flat or curved).

The method of operation of the present invention is illustrated in figure 3. The beacons FB1-14 are placed at different positions in the measured construction. Once the beacons installation on a target points and target surfaces is completed, the beacons are initialized and start to communicate with the three beacons of the central collector. Every beacon communicates with each of the central collector's three beacons. The protocol, that prevents collisions is used for all communications between beacons, is also included in the scope of the present invention. The signal transmission parameters information, the affiliation of the beacon to a specific group, and the identification of every beacon is coded and sent from each beacon to the three beacons of the central signal collector 100.

For each beacon the computer collects the distances measured between it and the three beacons of the central collector 100. The position of the central signal collector may be initialized according to the world coordinate system, or alternatively, its position may be defined in relation to four not coplanar field beacons. Based on this information the computer can then determine the exact position in space of each beacon. Beacons may be grouped in one of several group types: as surface defining beacons, as opening defining beacons and as distance defining beacons. For surface defining beacons are grouped in groups of three (for defining a flat surface) or more (for defining a curved surface); for opening defining beacons are grouped in groups of three (for triangular openings), four (for square openings) or more (for other shapes of openings); and the pair of beacons is used for distance defining. The grouping of the beacons may be performed via software or hardware means.

. Referring to figure 3 the three types of beacons are demonstrated. In order to define faces A, B, C three groups of beacons containing three beacons each are defined: beacons FB1, FB2 and FB3 for defining face A; beacons FB4, FB5 and FB6 for defining face B; and beacons FB7, FB8 and FB9 for defining face C. A single beacon FB10 is sufficient for defining face D (ceiling surface) that is parallel to the previously defined face C (floor surface). For the purpose of defining the opening of window W1 four beacons FB11, FB12, FB13 and FB14 are placed.

Knowing the position and the group type of each beacon allows the computer to accurately calculate the structure of the target construction. Knowing the position of faces A and B allows it to find the line of intersection and the intersection of this line with the surface of the floor C. This would give the position of point a. The same is then done with the surface of the ceiling in order to find point b. The computer can then accurately build a three dimensional virtual model, plans, elevation, and section drawings of the measured construction.

The present invention includes three principle embodiments. According to the first embodiment the beacon communicate via RF means. In this embodiment the distance measurement is performed using interpretation of the RF signal properties (frequencies, phases, etc.) and doesn't depend on the signal's time properties. The RF beacons may also be passive and respond to enquiry pulses from the central collector 100. In the second embodiment of the invention the communication between the beacons is performed by ultrasonic means. In this case all beacons must be active. The third embodiment is based on laser scanners. In this case the beacons are barcodes and the central collector is a laser scanner. The beacons in this instance are all passive and the central collector spots them by performing a minimal amount of scanning.

What is claimed is:

1. The wireless method and system for measuring distances, said system comprised of:

   - A least one beacon for marking measured target;

   - A central signal collector, comprised of a three transceivers assembled in a hard triangle structure.

   - A communication protocol that prevents collision,

   - A graphic processor;

   Wherein the information transmitted between the beacons, placed at the target positions and the central signal collector comprises data for distance measuring calculation.

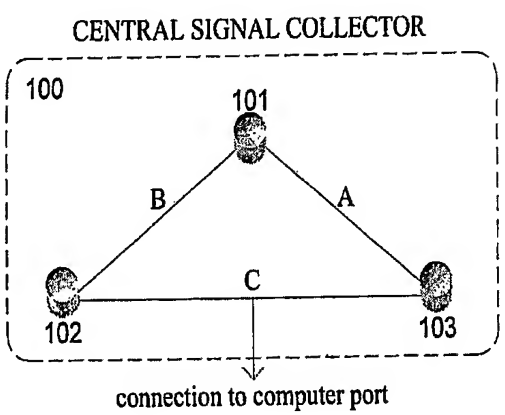

Figure 1

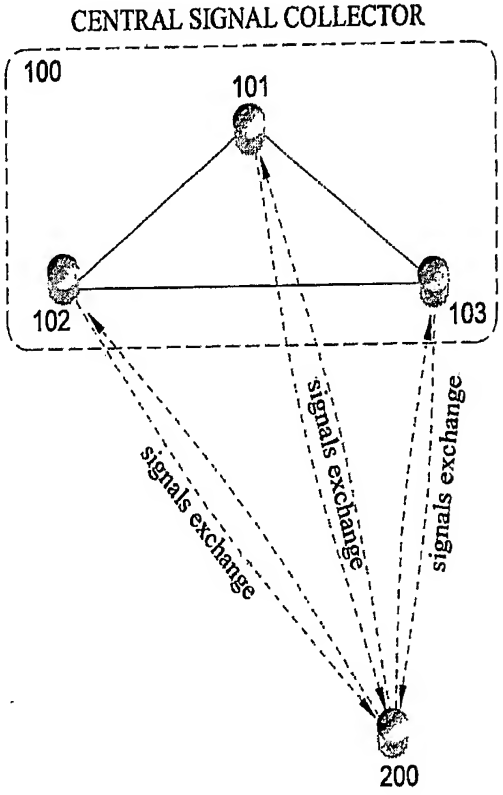

Figure 2

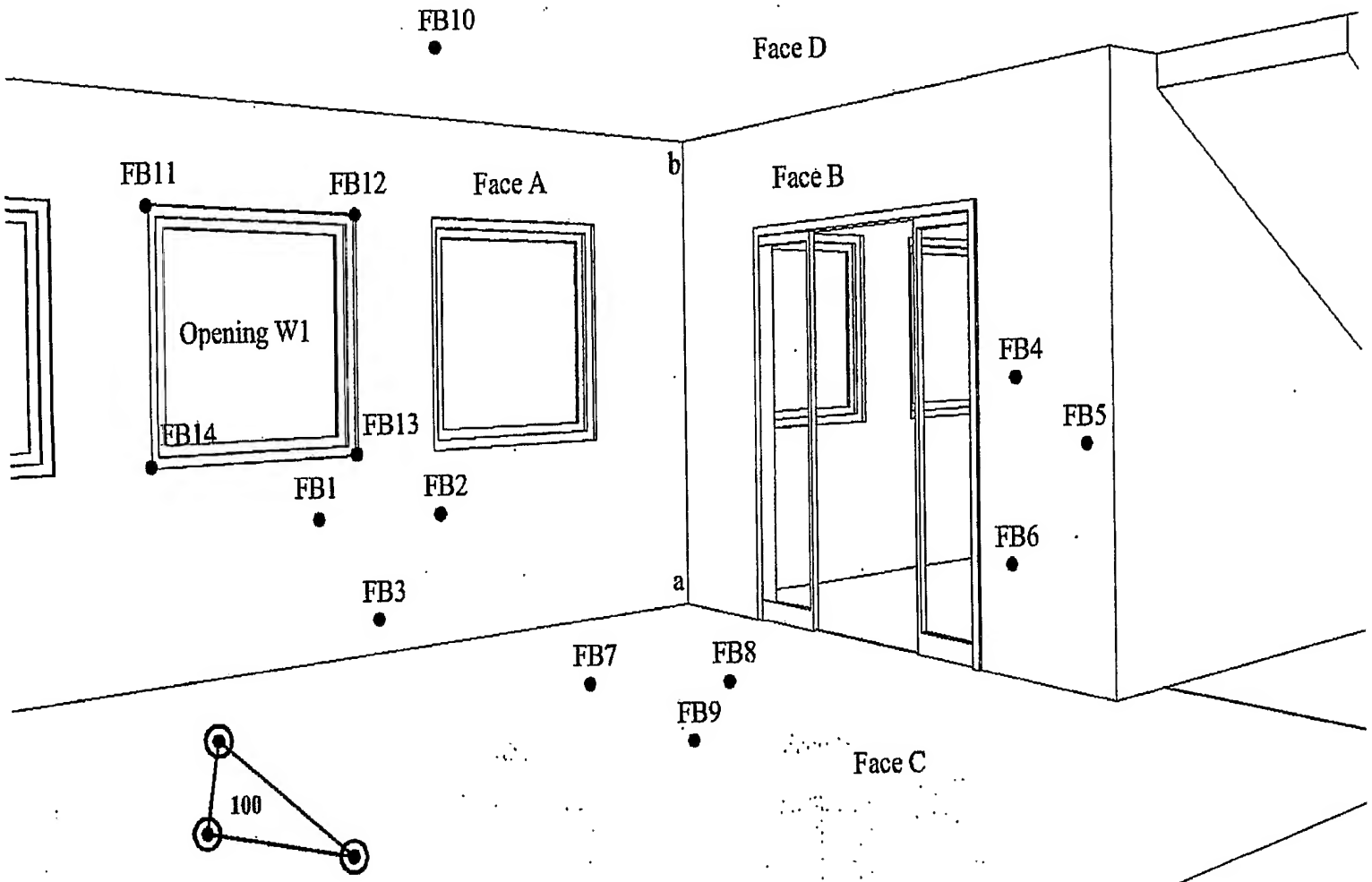

Figure 3